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Bird Community Monitoring at Herbert Hoover National Historic Site, Iowa

2005-2010 Status Report

Natural Resource Data Series NPS/HTLN/NRDS—2010/102

ON THE COVER
Herbert Hoover's birthplace
Photograph by: HTLN

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Introduction

Birds are an important component of park ecosystems, as their high body temperature, rapid metabolism, and high ecological position in most food webs make them good indicators of the effects of local and regional changes in ecosystems. It has been suggested that management activities aimed at preserving habitat for bird populations, such as for neotropical migrants, can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991, Maurer 1993). Moreover, birds have a tremendous following among the public and many parks provide information on the status and trends of birds through their interpretive programs.

We use trends in the composition and abundance of bird populations as long-term indicators of ecosystem integrity in the grassland habitat and developed areas of Herbert Hoover National Historic Site, Iowa (HEHO). Ecosystem integrity is defined as the system's capability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region (Karr and Dudley 1981). Research has demonstrated that birds serve as good indicators of changes in ecosystems (Cairns et al. 2004, Mallory et al. 2006, Wood et al. 2006).

Therefore, changes in the population size and community composition of birds on the park may reflect the effectiveness of management in restoring and maintaining the various vegetative communities at HEHO. Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity and sustainability of these systems.

Methods

Site Selection for Bird Plots

Permanent monitoring locations or 'plots' were selected by overlaying a systematic grid of 100 x 100-meter cells (originating from a random start point). The orientation of the grid was rotated 45 degrees to prevent monitoring sites from being influenced by man-made features (roads, fences, etc.) located along cardinal directions. We established 38 permanent plots on HEHO (Figure 1). However, in 2005 and 2006 only plots one through nine were sampled to assess the breeding bird community in the grassland habitat. In later years 28 plots were sampled in the grassland habitat to increase the likelihood of observing rare individuals, and to increase the number of observations made, thus creating the opportunity to more accurately estimate the abundances of all species. Additionally, 10 of the 38 permanent plots, those plots established in developed areas, were sampled since 2008 to assess the breeding bird communities found there.

During bird surveys, monitoring plots were located using navigation waypoints (Appendix 1) in a GPS unit and temporarily marked with 36-inch pin flags to aid in locating the plots for habitat assessment, eliminating the need for permanent plot markers. We collected pin flags from each plot once the habitat work was completed.

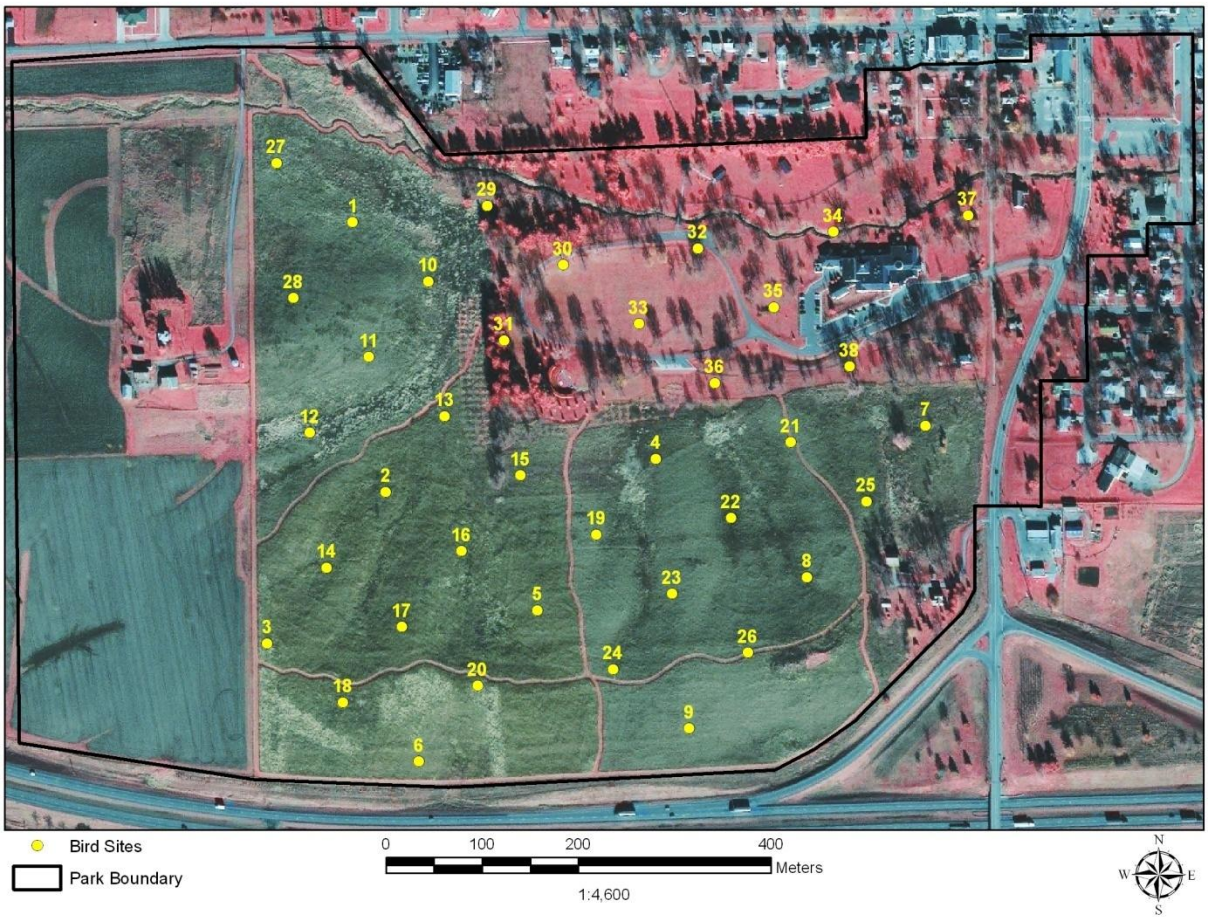

Figure 1. Bird plot locations on Herbert Hoover National Historic Site, Iowa. Plots 1 – 28 are located in the grassland habitat of the park, and plots 29 – 38 in developed areas.

Bird Surveys

Bird surveys followed methods outlined in the bird monitoring protocol by Peitz et al. (2008) and summarized below. Variable circular plot counts were used to survey birds present (Fancy 1997). All birds seen or heard at plots during 5-minute sampling periods were counted and their corresponding distances from observer(s) were recorded. Bird observations were separated into two time segments: those detected during the first three minutes of the count (to allow future comparisons with the national Breeding Bird Survey data), and any new birds detected during the final two minutes of the count. For most species, we recorded each individual bird as a separate observation. For species that usually occur in clusters or flocks, the units recorded were cluster or flock size, and not the individual bird. During analysis, each individual in a cluster or flock was treated as separate observations. For this report, all birds seen or heard during the full 5-minute were included.

After completing a count at a plot and filling out the data sheet, the observer(s) navigated to the next plot using a GPS unit. While traveling between plots, the observer(s) was vigilant for the presence of species not recorded during timed surveys. These species help formulate a more complete species list for the park by identifying species missed during timed surveys. We

sampled birds during a period when it was light enough to observe birds to four hours after sunrise. Table 1 listed the number plots sampled each year and sampling dates.

Table 1. Number of plots sampled, and sampling dates for breeding bird surveys conducted at Herbert Hoover National Historic Site, Iowa, by year. Also listed are observer(s) who conducted the surveys and whether or not habitat data was collected during the survey year.

Year	Sampling Dates	Number of Plots Sampled	Observer(s)	Habitat Data Collected
2005	June 4 – June 5	9	D.G. Peitz*	Yes
2006	June 3 – June 4	9	D.G. Peitz*	Yes
2008	June 10 – June 19	38	K. Lowder, J. Fuller	No
2009	May 26 – May 28	38	D.G. Peitz*, K. Lowder, J. Fuller, S. Middlemis-Brown	Yes
2010	May 19 – June 2	38	K. Lowder, J. Fuller	No

*Heartland I&M Network staff.

Bird Habitat

The collection of habitat data followed methods outlined in the bird monitoring protocol by Peitz et al. (2008). A summary of the sampling method's follows: habitat data collection started after the first variable circular plot count was completed. Observers visited plots for habitat measurements in the same order they were surveyed for birds, to avoid disturbing birds on a plot prior to the survey. Once the habitat crew arrived at a plot, they set up the center 5-meter radius subplot and completed all habitat measures for this subplot and the 50-meter radius plot. Habitat data was only collected in years when HTLN staff surveyed birds (Table 1).

We characterized habitat available for each bird species on a number of different scales. Slope, slope variability, aspect, aspect variability, and topographic position of each 50-meter radius plot were determined and recorded. These measurements were recorded during the first year of monitoring on a plot, and will not be re-measured in subsequent years. The amount of each vegetation type (cornfield, lawn, highway right-of-way, shrubland, soybean field, brome field, field/prairie, trail, drainage, or riparian prairie) and the amount of road and water cover on each plot were recorded. As plots were sampled, horizontal vegetation cover was estimated in 0.50-meter (2005-2006) or 0.25-meter (2009) intervals from 0.0 to 2.0 meters above ground surface using a 0.15-centimeter wide cover board. Area of the cover board obscured by vegetation was estimated at a 15-meter distances from plot center. Using a graduated measuring rod, vertical vegetation structure was measured in 1-meter increments up to 7.5 meters in height at four locations around the perimeter of the 5-meter subplot, corresponding to the four cardinal directions. Vertical structure was recorded for coniferous, deciduous, and herbaceous vegetation. Trees on the subplot were tallied by species and size classes based on diameter at breast height measured in centimeters (cm). The seven size classes assigned are: <1.0 cm, 1.1 – 2.5 cm, 2.6 – 8.0 cm, 8.1 – 15.0 cm, 15.1 – 23.0 cm, 23.1 – 38.0 cm, or >38.0 cm. Lastly, at the subplot, ground and foliar cover were recorded in a 1.78-meter radius nested sample plot. Ground cover included coniferous, deciduous, and grass litter; bare soil; rock; woody debris (>2.5 cm diameter); and unvegetated. Foliar cover was estimated for six plant guilds, including warm- and cool-season grasses, forbs, moss and lichens, shrubs and vines, tree seedlings, and total foliar cover (<1.5 meters tall). Average parameter values were reported for both the grassland habitat and developed areas.

Data Analysis

Prior to summary analysis, the residency status (permanent resident, summer resident, migrant, and winter resident) of each bird species recorded was determined. Identifying the residency of each species helps to exclude migrants and winter residents from analysis of breeding birds within HEHO. Hereafter, permanent and summer resident birds are referred to as breeding species. The frequency and abundance of breeding bird species were determined in two ways. First, for each breeding species, the number of individuals encountered per plot visit within a habitat was determined (individuals / plot visit). And second, the proportion of plots occupied by each breeding species within each habitat was determined (total number of plots occupied by a species / total number of plots visited).

Location and permanent abiotic measures on each plot and habitat subplot were determined. Habitat averages ($\pm$ std dev) for semi-permanent plot data, including road and water cover, were calculated from plot estimates. In 2005 and 2006, using plot values, averages for horizontal vegetation cover between 0 – 0.50 meters, 0.25-0.75 meters, 0.5 – 1.0 meters, 0.75-1.25 meters, 1.0 – 1.50 meters, 1.25-1.75 meters, and 1.5 – 2.00 meters were calculated by habitat type. In 2009, using plot values, averages for horizontal vegetation cover between 0 – 0.25 meters, 0.25-0.5 meters, 0.5 – 0.75 meters, 0.75-1.0 meters, 1.0 – 1.25 meters, 1.25-1.5 meters, 1.5 – 1.75 meters, and 1.75 – 2.0 meters were calculated by habitat type. Average vertical structure diversity and a standard deviation was estimated and reported as well.

$$\text{Structural Diversity Index} = \frac{((\sum p_i / 8) + a) * 100}{2}$$

Where "p_i" was the observed frequency for vegetation in the $_i$th interval touching a measuring rod out of 12 measuring events, and a – is the percent of intervals with recorded vegetation in eight height increments. Vertical structure diversity values are weighted equally to represent both the vertical height of vegetation and how dense the vegetation was within each height increment.

Within each habitat type, ground cover, including coniferous, deciduous and grass litter, bare soil, rock, woody debris (>2.5 cm DBH), and unvegetated were averaged ($\pm$ std dev) across plots. Foliar cover, by guild of warm- and cool-season grasses, forbs, mosses and lichens, shrubs and vines, tree seedlings and total foliar cover (<1.5 m tall) were averaged ($\pm$ std dev) across plots as well. Species composition and size classes of trees in the developed area of HEHO were also reported.

Results

Bird Surveys

Fifty-six bird species were recorded on HEHO during breeding bird surveys in 2005 – 2010, excluding 2007 (Table 2). Fifty-five of the 56 species were year round or summer residents. The Tennessee Warbler (*Vermivora peregrina*) was a migrant through the area. Four breeding species--Cedar Waxwing (*Bombycilla cedrorum),* Killdeer (*Charadrius vociferous*), Swamp Sparrow (*Melospiza Georgiana*), and Wild Turkey (*Meleagris gallopavo*)--were only recorded outside of 5-minute survey periods. The Brown Thrasher (*Toxostoma rufum*), Dickcissel (*Spiza americana*), Grasshopper Sparrow (*Ammodramus savannarum*), Indigo Bunting (*Passerina cyanea*), Red-bellied Woodpecker (*Melanerpes carolinus*), Swamp Sparrow (*Melospiza georgiana*), Willow Flycatcher (*Empidonax traillii*), and Yellow-throated Vireo (*Vireo flavifrons*) are breeding species of continental importance (Rich et al. 2004). Four grassland obligate species (i.e. species that required relatively treeless grasslands during their breeding cycle, Northern Prairie Wildlife Research Center 2009) were observed--Dickcissel, Eastern Meadowlark (*Sturnella magna*), Grasshopper Sparrow, and Sedge Wren (*Cistothorus platensis*). The American Robin (*Turdus migratorius*) was the most commonly encountered species in developed areas across years (Table 3). The Red-winged blackbird was the most commonly encountered species in grassland habitat. The American Robin was the most widely distributed species in both developed areas and grassland habitat (Table 4).

Table 2. Bird species recorded during breeding bird surveys at Herbert Hoover National Historical Site, Iowa in 2005 – 2010, excluding 2007.

Common name	Species name	AOU code	Residency[1]
American Crow	*Corvus brachyrhynchos*	AMCR	R
American Goldfinch	*Carduelis tristis*	AMGO	R
American Redstart	*Setophaga ruticilla*	AMRE	SR
American Robin	*Turdus migratorius*	AMRO	SR
Baltimore Oriole	*Icterus galbula*	BAOR	SR
Barn Swallow	*Hirundo rustica*	BARS	SR
Barred Owl	*Strix varia*	BDOW	R
Black-capped Chickadee	*Poecile atricapillus*	BCCH	R
Blue Jay	*Cyanocitta cristata*	BLJA	R
Brown-headed Cowbird	*Molothrus ater*	BHCO	R
Brown Thrasher	***Toxostoma rufum***	**BRTH**	**R**
Canada Goose	*Branta Canadensis*	CAGO	R
Cedar Waxwing*	*Bombycilla cedrorum*	CEDW	R
Chipping Sparrow	*Spizella passerine*	CHSP	SR
Chimney Swift	*Chaetura pelagic*	CHSW	SR
Cliff Swallow	*Petrochelidon pyrrhonota*	CLSW	SR
Common Grackle	*Quiscalus quiscula*	COGR	R
Common Nighthawk	*Chordeiles minor*	CONI	SR
Common Yellowthroat	*Geothlypis trichas*	COYE	SR
Dickcissel**	***Spiza americana***	**DICK**	**SR**
Downy Woodpecker	*Picoides pubescens*	DOWO	R
Eastern Kingbird	*Tyrannus tyrannus*	EAKI	SR
Eastern Meadowlark**	*Sturnella magna*	EAME	R
Eastern Wood-pewee	*Contopus virens*	EAWP	SR
European Starling	*Sturnus vulgaris*	EUST	R
Field Sparrow	*Spizella pusilla*	FISP	SR
Great Blue Heron	*Ardea Herodias*	GBHE	SR
Great Horned Owl	*Bubo virginianus*	GHOW	R
Gray Catbird	*Dumetella carolinensis*	GRCA	SR
Grasshopper Sparrow**	***Ammodramus savannarum***	**GRSP**	**SR**
House Sparrow	*Passer domesticus*	HOSP	R
House Wren	*Troglodytes aedon*	HOWR	SR
Indigo Bunting	***Passerina cyanea***	**INBU**	**SR**
Killdeer*	*Charadrius vociferous*	KILL	SR
Mallard	*Anas platyrhynchos*	MALL	R
Mourning Dove	*Zenaida macroura*	MODO	R
Northern Cardinal	*Cardinalis cardinalis*	NOCA	R
Northern Mockingbird	*Mimus polyglottos*	NOMO	R
Purple Martin	*Progne subis*	PUMA	SR
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	RBGR	SR
Rock Dove	*Columba livia*	RODO	R
Red-bellied Woodpecker	***Melanerpes carolinus***	**RBWO**	**R**
Red-winged Blackbird	*Agelaius phoeniceus*	RWBL	R
Ring-necked Pheasant	*Phasianus colchicus*	RPHE	R
Sedge Wren**	*Cistothorus platensis*	SEWR	SR
Song Sparrow	*Melospiza melodia*	SOSP	R

Table 2. Bird species recorded during breeding bird surveys at Herbert Hoover National Historical Site, Iowa in 2005 – 2010, excluding 2007 (continued).

Common name	Species name	AOU code	Residency[1]
Swamp Sparrow*	***Melospiza Georgiana***	**SWSP**	**R**
Tennessee Warbler	***Vermivora peregrine***	**TEWA**	**M**
Tree Swallow	*Tachycineta bicolor*	TRES	SR
Turkey Vulture	*Cathartes aura*	TUVU	SR
Warbling Vireo	*Vireo gilvus*	WAVI	SR
Willow Flycatcher	***Empidonax traillii***	**WIFL**	**SR**
Wild Turkey*	*Meleagris gallopavo*	WITU	R
Northern (Yellow-shafted) Flicker	*Colaptes auratus*	YSFL	R
Yellow Warbler	*Dendroica petechia*	YWAR	SR
Yellow-throated Vireo	***Vireo flavifrons***	**YTVI**	**SR**

*Species recorded only while traveling between point transects or at other times outside of 5-minute survey periods.

** Obligate grassland species. These species require relatively treeless grasslands for all or most of their breeding cycle (Northern Prairie Wildlife Research Center. Accessed in 2009, http://www.npwrc.usgs.gov/).

[1] Residency status: SR = summer resident; R = year around resident; M = migrant through the area (Stokes and Stokes 1996).

Species names are valid and verified names obtained from IT IS (Integrated Taxonomic Information System, Accessed in 2010, http://www.itis.usda.gov/).

Bolded species names are those species considered of continental importance (Rich et al. 2004).

Table 3. Number of individuals encountered per plot visit for bird species recorded in the grassland habitat and developed areas at Herbert Hoover National Historic Site, Iowa during breeding bird surveys. Individual species results are listed by year (2005-2010, excluding 2007). Number of individuals per plot includes all individuals recorded on plots during a 5-minute survey, including flyovers.

	2005	2006	2008		2009		2010	
	Grassland	Grassland	Grassland	Developed	Grassland	Developed	Grassland	Developed
Common Name	(n = 9)	(n = 9)	(n = 28)	(n = 10)	(n = 28)	(n = 10)	(n = 28)	(n = 10)
American Crow	--	--	--	--	0.04	--	0.39	0.30
American Goldfinch	0.33	0.78	0.32	--	0.93	0.10	2.46	0.40
American Redstart	--	--	--	0.10	--	--	--	--
American Robin	0.44	0.33	0.29	2.00	0.61	1.40	2.39	4.70
Baltimore Oriole	--	--	0.04	0.20	--	0.20	0.04	0.40
Barn Swallow	0.11	--	--	0.50	0.18	1.20	0.39	0.60
Black-capped Chickadee	--	--	--	--	--	--	--	0.10
Barred Owl	--	--	--	--	--	--	0.07	--
Blue Jay	0.11	--	--	0.10	0.11	--	0.11	0.80
Brown-headed Cowbird	0.22	0.11	0.07	--	0.21	0.50	0.14	0.30
Brown Thrasher	**--**	**0.11**	**0.04**	**0.10**	**--**	**0.10**	**0.25**	**0.10**
Canada Goose	--	--	0.36	--	--	--	--	--
Chipping Sparrow	--	--	--	--	--	0.10	0.11	1.10
Chimney Swift	--	--	0.04	0.20	0.11	--	0.14	--
Cliff Swallow	--	--	0.07	--	--	--	--	--
Common Grackle	0.56	0.33	0.79	0.80	0.82	1.70	1.93	5.30
Common Nighthawk	--	--	--	0.10	--	0.10	--	0.10
Common Yellowthroat	0.67	0.89	0.29	0.10	0.57	0.40	1.50	0.60
Dickcissel	**0.56**	**0.67**	**0.07**	**--**	**0.21**	**--**	**1.89**	**--**
Downy Woodpecker	--	--	--	--	--	--	--	0.10
Eastern Kingbird	0.11	--	--	--	0.07	--	0.14	--
Eastern Meadowlark	0.22	0.22	0.29	--	0.32	--	1.86	0.20
Eastern Wood-pewee	--	0.11	--	0.10	--	0.20	--	0.40
European Starling	0.33	--	0.07	0.30	0.29	0.90	0.04	1.10
Field Sparrow	--	--	--	--	0.07	--	0.11	--
Great Blue Heron	--	--	--	--	0.04	--	0.04	--
Great Horned Owl	--	--	0.04	--	--	--	--	--
Gray Catbird	--	--	0.04	0.10	0.07	0.10	--	0.50
Grasshopper Sparrow	**--**	**0.11**	**--**	**--**	**--**	**--**	**0.07**	**--**

Table 3. Number of individuals encountered per plot visit for bird species recorded in the grassland habitat and developed areas at Herbert Hoover National Historic Site, Iowa during breeding bird surveys. Individual species results are listed by year (2005-2010, excluding 2007). Number of individuals per plot includes all individuals recorded on plots during a 5-minute survey, including flyovers (continued).

	2005	2006	2008		2009		2010	
	Grassland	Grassland	Grassland	Developed	Grassland	Developed	Grassland	Developed
Common Name	(n = 9)	(n = 9)	(n = 28)	(n = 10)	(n = 28)	(n = 10)	(n = 28)	(n = 10)
House Sparrow	--	--	--	--	0.04	--	0.04	0.20
House Wren	--	--	--	--	0.14	0.10	0.11	0.10
Indigo Bunting	**--**	**--**	**--**	**0.10**	**0.04**	**0.20**	**0.25**	**0.60**
Mallard	--	--	--	--	0.14	--	0.04	--
Mourning Dove	0.11	0.11	0.18	0.40	0.25	0.20	0.46	1.30
Northern Cardinal	--	0.11	0.11	0.10	0.21	0.30	0.29	1.40
Northern Mockingbird	--	0.11	--	--	--	--	--	--
Purple Martin	--	--	--	--	0.07	0.20	--	--
Rose-breasted Grosbeak	--	--	0.04	0.20	0.04	--	--	--
Rock Dove	--	--	0.18	--	--	--	--	--
Red-bellied woodpecker	**--**	**--**	**--**	**--**	**--**	**--**	**0.04**	**--**
Red-winged Blackbird	2.78	3.33	0.61	0.20	1.93	0.10	5.04	1.30
Ring-necked Pheasant	0.11	0.22	--	--	0.14	--	--	--
Sedge Wren	--	--	--	--	--	0.10	--	--
Song Sparrow	--	--	0.11	0.10	0.32	--	0.32	0.30
Tree Swallow	--	--	--	--	0.04	--	--	--
Turkey Vulture	--	--	--	0.10	--	--	--	--
Warbling Vireo	--	--	--	--	--	--	0.04	0.30
Willow Flycatcher	**--**	**--**	**0.04**	**--**	**0.04**	**0.10**	**--**	**--**
Northern (Yellow-shafted) Flicker	--	--	--	0.10	--	--	--	--
Yellow Warbler	--	0.11	--	--	--	0.10	--	--
Yellow-throated Vireo	**--**	**--**	**--**	**--**	**--**	**--**	0.11	0.20

Bolded species names are those species considered of continental importance (Rich et al. 2004).

Table 4. Proportion of plots occupied by bird species in the grassland habitat and developed areas at Herbert Hoover National Historic Site, Iowa during breeding bird surveys. Individual species results are listed by year (2005-2010, excluding 2007). Proportion of plots occupied was determined using individuals recorded on plots during a 5-minute survey, including flyovers.

	2005	2006	2008		2009		2010	
Common name	Grassland (n = 9)	Grassland (n = 9)	Grassland (n = 28)	Developed (n = 10)	Grassland (n = 28)	Developed (n = 10)	Grassland (n = 28)	Developed (n = 10)
American Crow	--	--	--	--	0.04	--	0.21	0.20
American Goldfinch	0.33	0.44	0.14	--	0.32	0.10	0.75	0.20
American Redstart	--	--	--	0.10	--	--	--	--
American Robin	0.44	0.22	0.29	0.40	0.39	0.90	0.86	1.00
Baltimore Oriole	--	--	0.04	0.20	--	0.20	0.04	0.40
Barn Swallow	0.11	--	--	0.30	0.18	0.50	0.25	0.40
Black-capped Chickadee	--	--	--	--	--	--	--	0.10
Barred Owl	--	--	--	--	--	--	0.04	--
Blue Jay	0.11	--	--	0.10	0.07	--	0.07	0.30
Brown-headed Cowbird	0.22	0.11	0.07	--	0.21	0.20	0.04	0.20
Brown Thrasher	--	0.11	0.04	0.10	--	0.10	0.21	0.10
Canada Goose	--	--	0.04	--	--	--	--	--
Chipping Sparrow	--	--	--	--	--	0.10	0.07	0.60
Chimney Swift	--	--	0.04	0.10	0.07	--	0.11	--
Cliff Swallow	--	--	0.04	--	--	--	--	--
Common Grackle	0.22	0.11	0.43	0.30	0.46	0.50	0.75	1.00
Common Nighthawk	--	--	--	0.10	--	0.10	--	0.10
Common Yellowthroat	0.67	0.56	0.29	0.10	0.36	0.40	0.82	0.50
Dickcissel	0.44	0.33	0.07	--	0.18	--	0.71	--
Downy Woodpecker	--	--	--	--	--	--	--	0.10
Eastern Kingbird	0.11	--	--	--	0.07	--	0.07	--
Eastern Meadowlark	0.22	0.22	0.29	--	0.29	--	0.86	0.20
Eastern Wood-pewee	--	0.11	--	0.10	--	0.20	--	0.30
European Starling	0.11	--	0.07	0.20	0.04	0.40	0.04	0.50
Field Sparrow	--	--	--	--	0.07	--	0.11	--
Great Blue Heron	--	--	--	--	0.04	--	0.04	--
Great Horned Owl	--	--	0.04	--	--	--	--	--
Gray Catbird	--	--	0.04	0.10	0.07	0.10	--	0.30
Grasshopper Sparrow	--	0.11	--	--	--	--	0.07	--

Table 4. Proportion of plots occupied by bird species in the grassland habitat and developed areas at Herbert Hoover National Historic Site, Iowa during breeding bird surveys. Individual species results are listed by year (2005-2010, excluding 2007). Proportion of plots occupied was determined using individuals recorded on plots during a 5-minute survey, including flyovers (continued).

	2005	2006	2008		2009		2010	
Common name	Grassland (n = 9)	Grassland (n = 9)	Grassland (n = 28)	Developed (n = 10)	Grassland (n = 28)	Developed (n = 10)	Grassland (n = 28)	Developed (n = 10)
House Sparrow	--	--	--	--	0.04	--	0.04	0.20
House Wren	--	--	--	--	0.14	0.10	0.07	0.10
Indigo Bunting	--	--	--	0.10	0.04	0.20	0.21	0.30
Mallard	--	--	--	--	0.11	--	0.04	--
Mourning Dove	0.11	0.11	0.18	0.40	0.18	0.20	0.29	0.80
Northern Cardinal	--	0.11	0.11	0.10	0.21	0.20	0.29	0.60
Northern Mockingbird	--	0.11	--	--	--	--	--	--
Purple Martin	--	--	--	--	0.04	0.10	--	--
Rose-breasted Grosbeak	--	--	0.04	0.20	0.04	--	--	--
Rock Dove	--	--	0.04	--	--	--	--	--
Red-bellied Woodpecker	**--**	**--**	**--**	**--**	**--**	**--**	**0.04**	**--**
Red-winged Blackbird	0.89	1.00	0.36	0.20	0.75	0.10	1.00	0.90
Ring-necked Pheasant	0.11	0.22	--	--	0.14	--	--	--
Sedge Wren	--	--	--	--	--	0.10	--	--
Song Sparrow	--	--	0.11	0.10	0.29	--	0.18	0.30
Tree Swallow	--	--	--	--	0.04	--	--	--
Turkey Vulture	--	--	--	0.10	--	--	--	--
Warbling Vireo	--	--	--	--	--	--	0.04	0.30
Willow Flycatcher	--	--	0.04	--	0.04	0.10	--	--
Northern (Yellow-shafted) Flicker	--	--	--	0.10	--	--	--	--
Yellow Warbler	--	0.11	--	--	--	0.10	--	--
Yellow-throated Vireo	**--**	**--**	**--**	**--**	**--**	**--**	**0.11**	**0.20**

Bolded species names are those species considered of continental importance (Rich et al. 2004).

Bird Habitat

Abiotic features of plots sampled for breeding birds and habitat composition at HEHO are reported in Table 5. The slope of plots in both the grassland habitat and developed areas was ≤8 degrees. The variability of slope and aspect measurements was mostly low or medium for plots sampled. Plots were distributed relatively evenly across topographic position in the grassland habitat, with the exception of just two plots being located in shallow draws. Topographic positions of plots in developed areas of HEHO were on level ground, with the exception of one plot at mid-slope and two at low-slope.

Habitats on grassland plots consist primarily of the field/prairie type, with much lesser amounts of other types of habitat present (Table 6). Habitat on plots in developed areas consists primarily of lawn. Canopy cover was all but absent on grassland plots across years. In 2009, canopy cover was 51% on plots in the developed areas. Basal area of hardwood trees averaged 2.8 m^2 / ha and conifer trees averaged 0.9 m^2 / ha on plots in the developed area. Canopy height in developed areas averaged 15.9 meters for hardwoods and 2.4 meters for conifers. Tree species from five different families contributed to the canopy cover and basal area on plots in the developed area (Table 7).

In both grassland habitat and developed areas, the densest vegetation occurred in height classes below 0.75 meters, when read from a 15-meter distance (Table 6). However, in 2009 vegetation cover was recorded in all height classes within both habitat types. Average vertical structure diversity estimates were 8.7% for the grassland habitat and 19.4% for the developed areas.

Grass litter was the dominant litter type recorded across years and habitat types (Table 6). Plots in both habitat types were primarily unvegetated at the ground level. Across years, forbs and warm-season grass dominated the forage guilds on grassland plots during our mid-May bird surveys. Cool-season grass dominated the forage guilds of plots in the developed areas. Across years, total foliar coverage averaged slightly less than 49.0% on grassland plots. For plots in developed areas, total foliar coverage averaged 68.8%.

Table 5. Abiotic features of 50-meter radius plots sampled for breeding birds at Herbert Hoover National Historic Site, Iowa.

Plot number	Slope (°)	Slope variability	Aspect (°)	Aspect variability	Topographic position	Habitat type
HEHOTweety1	2	Low	22	Low	Lower-slope	Grassland
HEHOTweety2	4	Medium	31	Medium	Mid-slope	Grassland
HEHOTweety3	5	Medium	36	Medium	Upper-slope	Grassland
HEHOTweety4	4	Medium	310	Medium	Lower-slope	Grassland
HEHOTweety5	6	Medium	281	Medium	Upper-slope	Grassland
HEHOTweety6	6	Medium	116	Medium	Mid-slope	Grassland
HEHOTweety7	5	Medium	292	Medium	Mid-slope	Grassland
HEHOTweety8	5	Medium	316	Medium	Upper-slope	Grassland
HEHOTweety9	5	Medium	122	Medium	Upper-slope	Grassland
HEHOTweety10	4	Low	74	Low	Lower-slope	Grassland
HEHOTweety11	6	Low	92	Low	Mid-slope	Grassland
HEHOTweety12	4	Low	71	Low	Lower-slope	Grassland
HEHOTweety13	2	Low	55	Low	Lower-slope	Grassland
HEHOTweety14	4	Low	21	Low	Draw	Grassland
HEHOTweety15	8	Low	278	Low	Mid-slope	Grassland
HEHOTweety16	5	Low	20	Low	Draw	Grassland
HEHOTweety17	5	Low	331	Low	Upper-slope	Grassland
HEHOTweety18	2	Low	8	Medium	Upper-slope	Grassland
HEHOTweety19	8	Low	64	Low	Mid-slope	Grassland
HEHOTweety20	3	Low	351	Low	Upper-slope	Grassland
HEHOTweety21	7	Low	272	Low	Upper-slope	Grassland
HEHOTweety22	3	Low	47	Low	Mid-slope	Grassland
HEHOTweety23	7	Low	299	Low	Mid-slope	Grassland
HEHOTweety24	7	Low	18	Low	Upper-slope	Grassland
HEHOTweety25	4	Low	2	Low	Upper-slope	Grassland
HEHOTweety26	5	Low	352	Low	Upper-slope	Grassland
HEHOTweety27	3	Low	61	Low	Lower-slope	Grassland
HEHOTweety28	7	Low	351	Low	Mid-slope	Grassland
HEHOTweety29	2	Low	347	Low	Level	Developed
HEHOTweety30	2	Low	357	Low	Level	Developed
HEHOTweety31	7	Low	322	Low	Lower-slope	Developed
HEHOTweety32	2	Low	355	Low	Level	Developed
HEHOTweety33	4	Low	31	Low	Level	Developed
HEHOTweety34	2	Medium	67	Low	Level	Developed
HEHOTweety35	3	Low	342	Low	Level	Developed
HEHOTweety36	3	Low	324	Low	Lower-slope	Developed
HEHOTweety37	3	Low	1	Low	Level	Developed
HEHOTweety38	4	Low	350	Low	Mid-slope	Developed

Table 6. Averages (± std dev) for habitat parameters at Herbert Hoover National Historic Site, Iowa during the bird breeding season, 2005, 2006, and 2009. Within the scale in which habitat parameters were collected, 50-meter plot, 5-meter subplot and 1.78-meter sample plot, percentages of coverage may not necessarily sum to 100% as values were averaged over mid-point values of cover classes (i.e. class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%).

	2005	2006	2009	
	Grassland	Grassland	Grassland	Developed
	Mean (± Std dev)	Mean (± Std dev)	Mean (± Std dev)	Mean (± Std dev)
Habitat Parameter	(n = 9)	(n = 9)	(n = 28)	(n = 10)
50-meter plot coverage				
Cornfield (%)	0.33 (1.00)	--	--	--
Lawn (%)	0.39 (0.99)	--	--	60.60 (38.09)
Paved Road (%)	0.06 (0.17)	0.33 (1.00)	0.11 (0.57)	5.90 (12.02)
Highway Right-of-way (%)	4.50 (12.41)	1.67 (5.00)	0.11 (0.57)	--
Shrubland (%)	0.33 (1.00)	0.33 (1.00)	0.43 (1.07)	0.30 (0.95)
Pasture Road	--	1.06 (1.47)	1.39 (3.96)	--
Soybean Field	--	1.67 (5.00)	--	--
Brome Field	--	--	0.11 (0.57)	--
Field/Prairie	91.94 (6.59)	88.33 (15.21)	96.16 (3.94)	16.25 (27.04)
Trail	--	--	0.43 (1.07)	2.40 (4.65)
Drainage	--	--	--	3.75 (11.86)
Riparian Prairie	--	--	--	9.75 (30.83)
Stream	--	--	--	2.10 (4.70)
Other	--	--	--	0.30 (0.95)
5-meter plot coverage				
Canopy Cover				
Hardwood (%)	--	--	0.03 (0.15)	38.40 (43.25)
Conifer (%)	--	--	--	9.98 (31.57)
Total (%)	--	--	0.03 (0.15)	50.62 (47.27)
Canopy Height				
Hardwood (m)	--	--	0.05 (0.28)	15.89 (8.55)
Conifer (m)	--	--	--	2.39 (6.63)
Basal Area				
Hardwood (m^2 / ha)	--	--	0.04 (0.19)	2.80 (1.62)
Conifer (m^2 / ha)	--	--	--	0.90 (2.51)
Total (m^2 / ha)	--	--	0.04 (0.19)	3.70 (3.06)
Horizontal vegetation profile (prior to 2009) (meters)				
0.0 – 0.5 (%)	92.22 (11.89)	97.50 (0.00)	--	--
0.25 – 0.75 (%)	37.83 (28.74)	56.67 (28.01)	--	--
0.5 – 1.0 (%)	0.11 (0.00)	12.89 (32.10)	--	--
0.75 – 1.25 (%)	--	10.83 (32.50)	--	--
1.0 – 1.5 (%)	--	4.17 (12.50)	--	--
1.25 – 1.75 (%)	--	--	--	--
1.5 – 2.0 (%)	--	--	--	--

Table 6. Averages (± std dev) for habitat parameters at Herbert Hoover National Historic Site, Iowa during the bird breeding season, 2005, 2006, and 2009. Within the scale in which habitat parameters were collected, 50-meter plot, 5-meter subplot and 1.78-meter sample plot, percentages of coverage may not necessarily sum to 100% as values were averaged over mid-point values of cover classes (i.e. class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%; continued).

	2005	2006	2009	
	Grassland	Grassland	Grassland	Developed
	Mean (± Std dev)	Mean (± Std dev)	Mean (± Std dev)	Mean (± Std dev)
	(n = 9)	(n = 9)	(n = 28)	(n = 10)
Horizontal vegetation profile (2009) (meters)				
0.0 – 0.25 (%)	--	--	95.71 (4.45)	44.10 (39.10)
0.25 – 0.50 (%)	--	--	65.16 (37.15)	24.75 (40.16)
0.50 – 0.75 (%)	--	--	37.66 (40.13)	19.75 (38.09)
0.75 – 1.0 (%)	--	--	13.16 (23.55)	3.05 (6.30)
1.0 – 1.25 (%)	--	--	4.45 (12.28)	0.05 (0.16)
1.25 – 1.50 (%)	--	--	2.61 (11.78)	0.05 (0.16)
1.50 – 1.75 (%)	--	--	1.70 (7.08)	3.75 (11.86)
1.75 – 2.0 (%)	--	--	0.04 (0.13)	0.30 (0.95)
Vertical structure diversity	8.39 (0.17)	9.14 (2.43)	8.58 (1.39)	19.43 (9.40)
1.78-meter plot coverage				
Conifer Litter (%)	--	--	--	8.55 (26.86)
Deciduous Litter (%)	0.06 (0.17)	0.11 (0.22)	1.21 (2.97)	6.30 (6.07)
Grass Litter (%)	26.89 (33.51)	32.78 (15.58)	40.70 (39.43)	29.65 (28.89)
Bare Soil (%)	52.83 (33.04)	54.17 (12.50)	7.18 (9.13)	6.30 (11.84)
Rock (%)	--	0.17 (0.25)	--	--
Woody Debris (%)	--	--	0.52 (1.05)	2.70 (4.57)
Unvegetated (%)	75.00 (11.86)	82.50 (7.50)	53.13 (30.07)	55.80 (30.95)
Warm-season grass (%)	24.22 (22.05)	21.17 (12.85)	11.96 (17.70)	0.30 (0.95)
Cool-season grass (%)	0.61 (0.93)	1.50 (1.44)	19.77 (21.97)	58.30 (34.01)
Forb (%)	15.72 (13.72)	26.44 (18.51)	22.71 (20.89)	20.75 (24.51)
Moss and lichen (%)	--	0.33 (1.00)	--	0.05 (0.16)
Woody shrub and vine (%)	0.78 (1.28)	1.72 (4.98)	3.20 (11.99)	--
Tree seedling (%)	0.06 (0.17)	--	--	--
Total foliar (%)	46.11 (17.10)	48.61 (13.18)	52.23 (25.89)	68.75 (24.78)

Table 7. Stems per hectare of trees found in the developed areas of Herbert Hoover National Historic Site, Iowa during the 2009 bird breeding season, by size class. Stems per hectare of trees are reported by family in clusters by stem diameter, reported in centimeters.

Family	<1.0 cm	1.1 – 2.5 cm	2.6 – 8.0 cm	8.1 – 15.0 cm	15.1 – 23.0 cm	23.1 – 38.0 cm	>38.0 cm
Aceraceae	--	--	12.73	--	--	--	--
Fabaceae	--	--	--	--	--	--	12.73
Fagaceae	--	--	--	--	--	--	12.73
Pinaceae	--	--	50.93	--	--	--	12.73
Plantanaceae	--	--	--	--	--	--	12.73
Total Stems	**--**	**--**	**63.66**	**--**	**--**	**--**	**50.93**

Summary

Bird surveys and habitat assessment work were initiated at Herbert Hoover National Historic Site, Iowa in 2005, to assist the park in assessing the ecological integrity of the grassland habitat and to determine which bird species utilize habitat in the developed areas through time. Fifty-five of the 56 bird species are permanent or summer residents to the area (Stokes and Stokes 1996). Therefore, these 55 species with potential for reproducing on the park have some value in characterizing the breeding bird communities of HEHO.

Current efforts to restore and maintain the mixed vegetation at HEHO should provide a diversity of habitats necessary to support the eight breeding species of continental importance. Four grassland obligate species--Dickcissel, Eastern Meadowlark, Grasshopper Sparrow, and Sedge Wren--will serve as the best indicators of the ecological integrity of the grassland habitat on the park.

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Appendixes

Appendix 1. Plot I.D. and habitat type for each breeding bird survey plot at Herbert Hoover National Historic Site, Iowa. Also, reported are x and y UTM coordinates for each plot. UTM zone is 15N.

Plot I.D.	Habitat type	X Coordinate	Y Coordinate
HEHOTweety1	Grassland	636971.393	4614410.700
HEHOTweety2	Grassland	637005.863	4614129.966
HEHOTweety3	Grassland	636882.731	4613972.364
HEHOTweety4	Grassland	637286.597	4614164.436
HEHOTweety5	Grassland	637163.465	4614006.834
HEHOTweety6	Grassland	637040.333	4613849.232
HEHOTweety7	Grassland	637567.332	4614198.906
HEHOTweety8	Grassland	637444.200	4614041.304
HEHOTweety9	Grassland	637321.067	4613883.701
HEHOTweety10	Grassland	637050.194	4614349.134
HEHOTweety11	Grassland	636988.628	4614270.333
HEHOTweety12	Grassland	636927.062	4614191.532
HEHOTweety13	Grassland	637067.429	4614208.767
HEHOTweety14	Grassland	636944.297	4614051.165
HEHOTweety15	Grassland	637146.230	4614147.201
HEHOTweety16	Grassland	637084.664	4614068.400
HEHOTweety17	Grassland	637023.098	4613989.599
HEHOTweety18	Grassland	636961.532	4613910.798
HEHOTweety19	Grassland	637225.031	4614085.635
HEHOTweety20	Grassland	637101.899	4613928.033
HEHOTweety21	Grassland	637426.965	4614181.671
HEHOTweety22	Grassland	637365.399	4614102.870
HEHOTweety23	Grassland	637303.832	4614024.069
HEHOTweety24	Grassland	637242.266	4613945.268
HEHOTweety25	Grassland	637505.766	4614120.105
HEHOTweety26	Grassland	637382.633	4613962.502
HEHOTweety27	Grassland	636892.592	4614472.267
HEHOTweety28	Developed	636909.827	4614331.899
HEHOTweety29	Developed	637111.760	4614427.935
HEHOTweety30	Developed	637190.561	4614366.369
HEHOTweety31	Developed	637128.995	4614287.568
HEHOTweety32	Developed	637330.929	4614383.604
HEHOTweety33	Developed	637269.363	4614304.803
HEHOTweety34	Developed	637471.296	4614400.839
HEHOTweety35	Developed	637409.730	4614322.038
HEHOTweety36	Developed	637348.164	4614243.237
HEHOTweety37	Developed	637611.663	4614418.074
HEHOTweety38	Developed	637488.531	4614260.472